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13. ABSTRACT *(Maximum 200 words)*

We are continuing to make significant progress toward an Optoelectronic Graphics Display Processor. This period we have designed and are having fabricated, at no cost to ONR, some small prototype OEIC high-speed detector amplifiers and microlaser driver circuits. We are proceeding with our calculations of system bit error rate due to crosstalk and power loss, and have redesigned our system visualization and animation CAD component. Most importantly, we are extending our architecture to handle 3D scenes, that is, incorporation of a Z-buffer, and also extending it to handle color/gray scale.

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An Optoelectronic Graphics Display Processor - OGDP
Vincent P. Heuring
December 15, 1993

Finite State Control Unit - Lian Hua Ji, R. Feuerstein

We have submitted a paper to Applied Optics entitled, "Toward a free-space parallel optoelectronic computer: a 300 MHz optoelectronic counter using holographic interconnects. This paper describes our efforts toward the construction of an optoelectronic control unit to control the OGDP.

OEICs - Lian Hua Ji

Construction of the OGDP will depend on the availability of optoelectronic integrated circuits, OEICs. While others are developing OEICs, we feel it is important to maintain a small development effort toward the OEIC input and output, since our interest in OEIC I/O is toward devices with small latency and high bandwidth. Therefore we have designed an input detector amplifier and laser driver, and MOSIS is currently fabricating our designs. (At this point, the development is not costing the ONR grant any money, since we have submitted the designs using a classroom account.)

Holographic Optical Elements - V. Morozov, P. Disterhoft

We are still experimenting with Dupont Photopolymer as a means of making our high-efficiency holographic optical elements. Since that effort requires production of the hologram at a different wavelength than that used for reconstruction, we are now examining the use of phase holograms using a multi-level mask approach. This technique has the advantage that there is no additional processing step once the hologram is fabricated. It has the disadvantage that several masks need to be prepared in order to make one hologram.

CAD System - V. Morozov, V. Heuring, I. Jones, H. Zhou

We hare proceeding in our efforts to understand the physics of crosstalk and loss in holographically interconnected OEICs, and in the visualization and animation of the architecture. The crosstalk and loss calculations are yielding results. We are using a quantitative model that we have developed to compute diffraction crosstalk due to diffraction beam spreading. Calculations are beginning to indicate how significant the contribution of fanin and fanout will be toward degradation of bit error rate. During the next reporting period we will be computing a quantitative estimate of how significant the contribution toward the bit error rate is.

The system animation/visualization software is being rewritten in a form that will allow its inclusion into our proposed optical CAD system. That system is currently being designed, and will be reported on in more detail in the next quarterly report.

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September 20, 1993

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Dear Sir:

Enclosed are two copies of our quarterly report on An Opto-electronic Graphics Display Processor - OGDP.

Sincerely yours,

Vincent P. Heuring
Associate Professor

VPH mjr
encs

Algorithms and Architectures - M. Berg, V. Heuring

We have begun extending our 2-D architecture to the handling of 3-D images with color/gray scale. The original architecture accumulated 2-D, binary polygons. This extension will extend the architecture to include z-buffering, that is, the inclusion of the third dimension in the polygons. Each pixel of each polygon is compared for its z-value and replaces the pixel currently in the frame buffer only if its z-value indicates that it is closer to the viewer than the pixel currently in the frame buffer. We are also allowing a color/gray scale value to be associated with each pixel, as compared to a binary on/off value in the original architecture.